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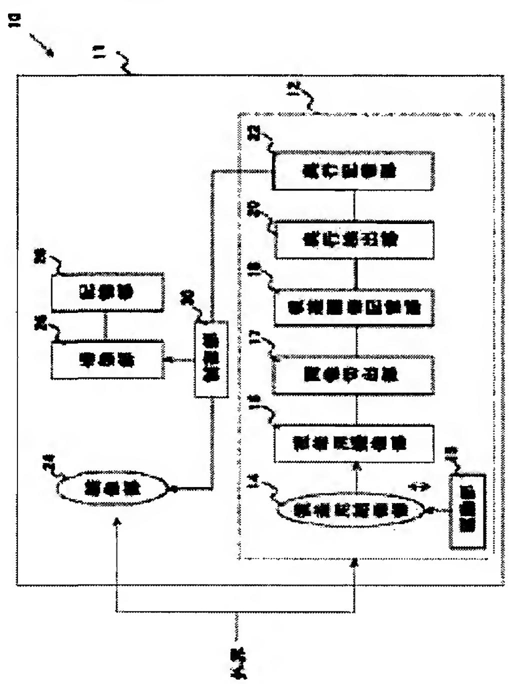
(54) PARALLAX IMAGE-INPUTTING DEVICE AND IMAGE PICKUP DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To easily obtain a parallax image and also easily obtain the depth information of a subject.
SOLUTION: A parallax image-inputting device 10 for acquiring the image of the outside world when viewed from a plurality of viewpoints is provided with an image-forming part 14 for parallax for connecting the image of the outside world when viewed from the viewpoints, an enclosure 11, a drive part 15 for changing a viewpoint by moving the image-forming part 14 for parallax for the enclosure 11, and an image pickup part 16 for parallax for taking in the image of a plurality of outside field images when viewed from a different viewpoint formed by the image-forming part 14 for parallax.



CLAIMS

[Claim(s)]
[Claim 1]An image formation part for azimuth difference which is a parallax image input device which acquires a picture of the external world seen from two or more viewpoints, and connects a picture of the external world seen from said viewpoint, A parallax image input device having an image pick-up part for azimuth difference which captures an image of said external world seen from said viewpoint connected by said image formation part for azimuth difference, and an image formation part actuator for azimuth difference which moves said image formation part for azimuth difference, and changes said viewpoint to said image pick-up part for azimuth difference.
[Claim 2]An image formation part for azimuth difference which is a parallax image input device which acquires a picture of the external world seen from two or more viewpoints, and connects a picture of the external world seen from said viewpoint, A parallax image input device having an image formation part actuator for azimuth difference which moves said image formation part for azimuth difference, and changes said viewpoint, and an image pick-up part for azimuth difference which captures an image of two or more of said external worlds seen from a different viewpoint connected by said image formation part for azimuth difference to a case and said case.
[Claim 3]The parallax image input device according to claim 2 having further an image pick-up part actuator for azimuth difference which moves said image pick-up part for azimuth difference to said case, and changing a position of said image pick-up part for azimuth difference for said every viewpoint by said image pick-up part actuator for azimuth difference.
[Claim 4]The parallax image input device according to claim 3, wherein said image pick-up part actuator for azimuth difference moves said image pick-up part for azimuth difference based on an interval of movement of parallax directions of an image formation part for azimuth difference by said image formation part actuator for azimuth difference.
[Claim 5]The parallax image input device according to claim 1 or 2 having further a taking-in control section which changes a range which captures an image on an acceptance surface of said image pick-up part for azimuth difference for said every viewpoint.
[Claim 6]An image formation part for azimuth difference of a single optical axis which is a parallax image input device which acquires a picture of the external world seen from two or more viewpoints, and connects a picture of said external world, A light passage control section which has the 1st opening and the 2nd opening used as a viewpoint which passes light which penetrated said image formation part for azimuth difference, An image pick-up part for azimuth difference which captures the 1st picture of the external world by light which passed the 1st opening of said light passage control section, and the 2nd image of the external world by light which passed the 2nd opening, A parallax image input device having a taking-in control section which changes a range which captures an image on an acceptance surface of said image pick-up part for azimuth difference by picture seen from said 1st opening, and a picture seen from said 2nd opening based on an interval with said 1st opening and the 2nd opening.
[Claim 7]The parallax image input device according to any one of claims 1 to 6 having further a depth primary detecting element which detects depth information of a predetermined photographic subject of said external world based on a picture captured by said image pick-up part for azimuth difference.
[Claim 8]An image formation system which connects a picture of said external world which is an imaging device which picturizes the desired external world, and was seen from two or more viewpoints, As opposed to an imaging system which picturizes said picture connected by said image

formation system, and said imaging system, Based on a picture of said external world seen from an image formation system actuator which moves said image formation system and changes said viewpoint, and said different viewpoint picturized by said imaging system, An imaging device having a depth primary detecting element which detects depth information corresponding to distance to a predetermined photographic subject of said external world, and a control section which controls said image formation system or said imaging system based on depth information detected by said depth primary detecting element.
[Claim 9]Have said image formation system and an image formation part which connects a picture of the external world from said viewpoint, and an image formation part for azimuth difference which connects a picture of the external world seen from said two or more viewpoints said imaging system, Have an image pick-up part which picturizes said picture connected by said image formation part, and an image pick-up part for azimuth difference which captures an image of said external world seen from said viewpoint connected by said image formation part for azimuth difference, and said image formation system actuator receives said image pick-up part for azimuth difference, Have an image formation part actuator for azimuth difference which moves said image formation part for azimuth difference, and changes said viewpoint, and said depth primary detecting element, Based on a picture of said external world seen from a different viewpoint picturized by said image pick-up part for azimuth difference, detect depth information corresponding to distance to a predetermined photographic subject of said external world, and said control section, The imaging device according to claim 8 characterized by controlling said image formation part or said image pick-up part based on depth information detected by said depth primary detecting element.
[Claim 10]An image formation system which connects a picture of said external world which is an imaging device which picturizes the desired external world, and was seen from two or more viewpoints, As opposed to an imaging system which picturizes said picture connected by said image formation part, a case, and said case, A depth primary detecting element which detects depth information corresponding to distance to a predetermined photographic subject of said external world based on a picture of said external world seen from an image formation system actuator which moves said image formation system and changes said viewpoint, and a different viewpoint picturized by said imaging system, An imaging device having a control section which controls said image formation system or said imaging system based on depth information detected by said depth primary detecting element.
[Claim 11]Have the following, have said image formation system actuator to said case, and an image formation part actuator for azimuth difference which moves said image formation part for azimuth difference, and changes said viewpoint said depth primary detecting element, Based on a picture of said external world seen from a different viewpoint picturized by said image pick-up part for azimuth difference, detect depth information corresponding to distance to a predetermined photographic subject of said external world, and said control section, The imaging device according to claim 10 characterized by controlling said image formation part or said image pick-up part based on depth information detected by said depth primary detecting element.
An image formation part to which said image formation system connects a picture of said external world.
An image pick-up part which picturizes said picture which has an image formation part for azimuth difference which connects a picture of the external world seen from said viewpoint, and with which said imaging system was connected by said image formation part.
An image pick-up part for azimuth difference which captures an image of two or more of said external worlds seen from a different viewpoint connected by said image formation part for azimuth difference.

[Claim 12]An imaging device which picturizes the desired external world, comprising:
An image formation system which connects a picture of said external world.
A light passage control section which has the 1st opening and the 2nd opening used as a viewpoint which passes light which penetrated said image formation system.
An imaging system which picturizes said picture connected by said image formation system.
Based on an interval with said 1st opening and the 2nd opening, by picture seen from said 1st opening, and a picture seen from said 2nd opening. A taking-in control section which changes a range which captures an image on an acceptance surface of said imaging system, A control section by which a range incorporated by the aforementioned taking-in control section controls said image formation

system or said imaging system based on depth information detected by a depth primary detecting element which detects depth information corresponding to distance to a predetermined photographic subject of said external world, and said depth primary detecting element based on said different-**** (ed) picture.

[Claim 13]Have said image formation system and an image formation part which connects a picture of said external world, and an image formation part for azimuth difference of a single optical axis which connects a picture of the external world seen from said viewpoint said light passage control section, Have the 1st opening and the 2nd opening used as a viewpoint which passes light which penetrated said image formation part for azimuth difference, and said imaging system, It has an image pick-up part for azimuth difference which captures the 1st picture of the external world by light which passed the 1st opening of an image pick-up part which picturizes said picture connected by said image formation part, and said light passage control section, and the 2nd image of the external world by light which passed the 2nd opening, The aforementioned taking-in control section is with a picture seen from said 1st opening based on an interval with said 1st opening and the 2nd opening, and a picture seen from said 2nd opening, Make ranges which capture an image on an acceptance surface of said image pick-up part for azimuth difference differ them, and said depth primary detecting element, Based on said picture captured by said image pick-up part for azimuth difference, detect depth information corresponding to distance to a predetermined photographic subject of said external world, and said control section, The imaging device according to claim 12 characterized by controlling said image formation part or said image pick-up part based on depth information detected by said depth primary detecting element.

[Claim 14]The imaging device according to any one of claims 8 to 13, wherein said imaging system has an optoelectric transducer.

[Claim 15]The imaging device according to any one of claims 8 to 13, wherein said imaging system has an installation section which installs a photochemical reaction component.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the parallax image input device and imaging device which capture the image seen from two or more viewpoints.
[0002]
[Description of the Prior Art]The technology of putting a camera on several different viewpoints conventionally, extracting the corresponding points between two or more pictures which captured and captured the image of the same photographic subject in each viewpoint, asking for the distance map to a photographic subject, and asking for the three-dimensional form of a photographic subject based on this distance map is known. Thus, the equipment which photos a parallax picture is known as equipment which captures an image from a different viewpoint, moving the whole photographing system. For example, JP,H9-44677,A (it is called document 1) has disclosed the camera moving mechanism to which the whole camera is moved.
[0003]JP,H10-229566,A (it is called document 2) has disclosed the digital camera system having a means to carry out the seriography of the same photographic subject, and to save two or more pictures while moving, and a means to extract the movement magnitude of the image element between two or more saved pictures as depth information of a photographic subject. In order to photo a parallax picture, a camera is changed to animation photographing mode, and this system is indicated to carry out the seriography of the same photographic subject, moving the camera concerned in the direction which goes to an optical axis direction when a still picture is photoed direct.
[0004]On the other hand, JP,H10-42314,A (it is called document 3) has disclosed the parallax image input device of the single lens system consisting of a light transmission range control means of the light control means which defines the light transmission range in the pupil surface of an optical lens, and the light control means which transmits selectively only the picture information which moves the light transmission range of a light control means in the direction parallel to the pupil surface of said optical lens, and passes the specific position of an optical lens, and an imaging means which picturizes the picture information transmitted by the light control means, and is changed into an image data sequence.
[0005]JP,H10-271534,A (it is called document 4) has disclosed the stereoscopic picture photographing instrument which is arranged at the position from which only a predetermined distance separated the light of the photographic subject focusing on the optic-axis middle of the optical system which carries out image formation to a solid state image sensor, and an optical system, is provided with two or more light modulation mechanisms which penetrate or shade the light from a photographic subject, makes a transmission state one of said each of the light modulation mechanism with a predetermined time interval, and makes the remainder a shaded state.
[0006]
[Problem to be solved by the invention]In invention indicated in above-mentioned document 1, there was a problem that a camera moving mechanism and a control device became large-scale. Change a camera to animation photographing mode, in invention indicated in document 2, in order to photo a parallax picture, there is a description that the seriography of the same photographic subject is carried out, moving in the direction which goes to an optical axis direction when a still picture is photoed direct, but. It is not indicated how a camera is moved. Although it is thought that the moving mechanism which can be controlled with high precision in this case, for example, a means to measure

the locus of camera movement in three dimensions, and to record it, the mechanism in which the locus of movement of a camera is presumed, etc. are needed, it is dramatically difficult to prepare such equipment, and it is not realistic.
[0007]In the equipment indicated to document 3 or 4, the angle variation of the optic axis is included in the picture acquired with azimuth difference by the effect of the refracting power of a lens, the operation which computes the parallax amount about a predetermined photographic subject and the depth information (depth position) of the photographic subject concerned from a picture became complicated, and the problem that processing time was long had arisen. Then, an object of this invention is to provide the parallax image input device and imaging device which can obtain a parallax picture easily and can acquire the depth information of a photographic subject easily. This purpose is attained by the combination of the feature given in the independent clause in Claims. Dependent claim specifies the further advantageous example of this invention.
[0008]
[Means for solving problem]To achieve the above objects, the parallax image input device which this invention requires for the 1st form of this invention is characterized by that the parallax image input device which acquires the picture of the external world seen from two or more viewpoints comprises the following.
The image formation part for azimuth difference which connects the picture of the external world seen from the viewpoint.
The image pick-up part for azimuth difference which captures the image of the external world seen from the viewpoint connected by the image formation part for azimuth difference.
The image formation part actuator for azimuth difference which moves the image formation part for azimuth difference, and changes a viewpoint to the image pick-up part for azimuth difference.

[0009]The parallax image input device which this invention applies to the 2nd form of this invention to achieve the above objects is characterized by that the parallax image input device which acquires the picture of the external world seen from two or more viewpoints comprises:
The image formation part for azimuth difference which connects the picture of the external world seen from the viewpoint.
Case.
The image formation part actuator for azimuth difference which is held at a case, moves the image formation part for azimuth difference, and changes a viewpoint.
The image pick-up part for azimuth difference which captures the image of two or more external worlds seen from a different viewpoint connected by the image formation part for azimuth difference.

[0010]It has further an image pick-up part actuator for azimuth difference which moves the image pick-up part for azimuth difference to a case, and may be made to change the position of the image pick-up part for azimuth difference for every viewpoint by the image pick-up part actuator for azimuth difference. It may be made for the image pick-up part actuator for azimuth difference to move the image pick-up part for azimuth difference based on the interval of movement of the parallax directions of the image formation part for azimuth difference by the image formation part actuator for azimuth difference. It may be made for a taking-in control section to be provided with the taking-in control section which changes the range which captures the image on the acceptance surface of the image pick-up part for azimuth difference for every viewpoint.
[0011]To achieve the above objects, the parallax image input device which this invention requires for the 3rd form of this invention is characterized by that the parallax image input device which acquires the picture of the external world seen from two or more viewpoints comprises the following.
The image formation part for azimuth difference of a single optical axis which connects the picture of the external world.
The light passage control section which has the 1st opening and the 2nd opening used as the viewpoint which passes the light which penetrated the image formation part for azimuth difference.
The image pick-up part for azimuth difference which captures the 1st picture of the external world by the light which passed the 1st opening of the light passage control section, and the 2nd image of the external world by the light which passed the 2nd opening.
The taking-in control section which changes the range which captures the image on the acceptance

surface of the image pick-up part for azimuth difference based on an interval with the 1st opening and the 2nd opening by the picture seen from the 1st opening, and the picture seen from the 2nd opening. It may be made to have further a depth primary detecting element which detects the depth information of the predetermined photographic subject of the external world in the picture input device for azimuth difference concerning this invention based on the picture captured by the image pick-up part for azimuth difference.
[0012]To achieve the above objects, the imaging device which this invention requires for the 1st form of this invention is characterized by that the imaging device which picturizes the desired external world comprises the following.
The image formation system which connects the picture of the external world seen from two or more viewpoints.
The imaging system which picturizes the picture connected by the image formation system.
The image formation system actuator which moves an image formation system and changes a viewpoint to an imaging system.
The control section which controls an image formation system or an imaging system based on the depth information detected by the depth primary detecting element which detects the depth information corresponding to the distance to the predetermined photographic subject of the external world, and the depth primary detecting element based on the picture of the external world seen from a different viewpoint picturized by the imaging system.

[0013]Have an image formation system and the image formation part which connects the picture of the external world from a viewpoint, and the image formation part for azimuth difference which connects the picture of the external world seen from two or more viewpoints an imaging system, Have an image pick-up part which picturizes the picture connected by the image formation part, and an image pick-up part for azimuth difference which captures the image of the external world seen from the viewpoint connected by the image formation part for azimuth difference, and an image formation system actuator, Have an image formation part actuator for azimuth difference which moves the image formation part for azimuth difference, and changes a viewpoint to the image pick-up part for azimuth difference, and a depth primary detecting element, Based on the picture of the external world seen from a different viewpoint picturized by the image pick-up part for azimuth difference, the depth information corresponding to the distance to the predetermined photographic subject of the external world is detected, and it may be made for a control section to control an image formation part or an image pick-up part based on the depth information detected by the depth primary detecting element.
[0014]To achieve the above objects, the imaging device which this invention requires for the 2nd form of this invention is characterized by that the imaging device which picturizes the desired external world comprises the following.
The image formation system which connects the picture of the external world seen from two or more viewpoints.
The imaging system which picturizes the picture connected by the image formation part.
Case.
The image formation system actuator which moves an image formation system and changes a viewpoint to a case, The control section which controls an image formation system or an imaging system based on the depth information detected by the depth primary detecting element which detects the depth information corresponding to the distance to the predetermined photographic subject of the external world, and the depth primary detecting element based on the picture of the external world seen from a different viewpoint picturized by the imaging system.

[0015]Have an image formation system and the image formation part which connects the picture of the external world, and the image formation part for azimuth difference which connects the picture of the external world seen from the viewpoint an imaging system, Have an image pick-up part which picturizes the picture connected by the image formation part, and an image pick-up part for azimuth difference which captures the image of two or more external worlds seen from a different viewpoint connected by the image formation part for azimuth difference, and an image formation system actuator, Have an image formation part actuator for azimuth difference which moves the image formation part for azimuth difference, and changes a viewpoint to a case, and a depth primary

detecting element, Based on the picture of the external world seen from a different viewpoint picturized by the image pick-up part for azimuth difference, the depth information corresponding to the distance to the predetermined photographic subject of the external world is detected, and it may be made for a control section to control an image formation part or an image pick-up part based on the depth information detected by the depth primary detecting element.
[0016]The imaging device which this invention applies to the 3rd form of this invention to achieve the above objects is characterized by that the imaging device which picturizes the desired external world comprises:
The image formation system which connects the picture of the external world.
The light passage control section which has the 1st opening and the 2nd opening used as the viewpoint which passes the light which penetrated the image formation system.
The imaging system which picturizes the picture connected by the image formation system.
Based on an interval with the 1st opening and the 2nd opening, by the picture seen from the 1st opening, and the picture seen from the 2nd opening. The taking-in control section which changes the range which captures the image on the acceptance surface of an imaging system, The control section by which the range incorporated by a taking-in control section controls an image formation system or an imaging system based on the depth information detected by the depth primary detecting element which detects the depth information corresponding to the distance to the predetermined photographic subject of the external world, and the depth primary detecting element based on the different-**** (ed) picture.

[0017]Have an image formation system and the image formation part which connects the picture of the external world, and the image formation part for azimuth difference of a single optical axis which connects the picture of the external world seen from the viewpoint a light passage control section, Have the 1st opening and the 2nd opening used as the viewpoint which passes the light which penetrated the image formation part for azimuth difference, and an imaging system, It has an image pick-up part for azimuth difference which captures the 1st picture of the external world by the light which passed the 1st opening of the image pick-up part which picturizes the picture connected by the image formation part, and a light passage control section, and the 2nd image of the external world by the light which passed the 2nd opening, A taking-in control section is with the picture seen from the 1st opening based on the interval with the 1st opening and the 2nd opening, and the picture seen from the 2nd opening, Make the ranges which capture the image on the acceptance surface of the image pick-up part for azimuth difference differ them, and a depth primary detecting element, Based on the picture captured by the image pick-up part for azimuth difference, the depth information corresponding to the distance to the predetermined photographic subject of the external world is detected, and it may be made for a control section to control an image formation part or an image pick-up part based on the depth information detected by the depth primary detecting element.
[0018]It may be made for an image pick-up part to have an installation section which it may be made to have an optoelectric transducer and installs a photochemical reaction component. An outline of the above-mentioned invention is not what enumerated all the required features of this invention, and a subcombination of these characterizing group can also be invented.
[0019]
[Mode for carrying out the invention]Although this invention is hereafter explained through an embodiment of the invention, not all the combination of the feature of following embodiments that do not limit invention concerning Claims and are explained in an embodiment is necessarily indispensable to a solving means of invention. Drawing 1 shows composition of a digital camera as an example of an imaging device containing a parallax image input device concerning a 1st embodiment of this invention. Here, a video camera etc. which picturize continuously not only a camera that picturizes a picture for every sheet but a picture are contained in a digital camera. The imaging device 10 is provided with the following.
It has the case 11 and is the image formation part 24 in the case 11 concerned.
The image pick-up part 26.
The storage parts store 28.
The parallax image input device body part 12 which has the picture slicing part 17, the parallax picture storage parts store 18, the depth primary detecting element 20, and the depth storage parts store 22

as an example of the actuator 15 as an example of the image formation part 14 for azimuth difference, an image formation system actuator, and an image formation part actuator for azimuth difference, the image pick-up part 16 for azimuth difference, and a taking-in control section, and the control section 30.
Here, an image formation system said to Claims is constituted by the image formation part 24 and the image formation part 14 for azimuth difference, and an imaging system is constituted from this embodiment by the image pick-up part 26 and the image pick-up part 16 for azimuth difference.
[0020]The image formation part 24 has the singular number or two or more lenses, and connects the picture of the external world on the acceptance surface of the image pick-up part 26 by collecting the lights from the external world, for example. The image pick-up part 26 captures the image connected on the acceptance surface. According to this embodiment, the image pick-up part 26 is CCD (Charge Coupled Device) as an example of an optoelectric transducer, changes into image data the picture connected on the acceptance surface, and captures it. The storage parts store 28 memorizes the image data changed by the image pick-up part 26.
[0021]The image formation part 14 for azimuth difference has the singular number or two or more lenses, and connects the picture of the external world on the acceptance surface of the image pick-up part 16 for azimuth difference, for example. The actuator 15 moves the image formation part 14 for azimuth difference to the case 11. Thereby, the picture seen from two or more viewpoints can be acquired. In this embodiment, it moves the image formation part 14 for azimuth difference in the direction vertical to the optic axis concerned, the actuator 15 maintaining an optic axis in parallel. It is made to move in this embodiment between two view positions (one side is called 1st view position and another side is called 2nd view position) which were able to determine beforehand the image formation part 14 for azimuth difference by the actuator 15. If it does in this way, composition of the actuator 15 can be simplified, and the interval of the parallax directions to which a view position is connected can always be fixed, and it is not necessary to have the composition which measures the interval of the parallax directions of a view position.
[0022]The image pick-up part 16 for azimuth difference captures the image of the external world seen from two or more viewpoints connected by the image formation part 14 for azimuth difference. According to this embodiment, the image pick-up part 16 for azimuth difference is CCD as an example of an optoelectric transducer, changes into image data the picture connected on the acceptance surface, and captures it. In this embodiment, it is fixed to the case 11 and the image pick-up 16 for azimuth difference cannot be moved. The picture slicing part 17 determines a logging (cropping) range which is different based on the interval of the parallax directions to which the viewpoint about two or more viewpoints is connected, respectively about two or more image data seen from two or more viewpoints, and starts each image data according to the range concerned.
[0023]It may be made to change here the logging range of two or more image data seen from two or more viewpoints depended on the picture slicing part 17 by the value obtained by the linearity predetermined function which makes these viewpoint intervals a variable. If it does in this way, the image data from two or more viewpoints acquired by making move the whole camera as shown in a conventional example in parallel with the optic axis of a camera lens, and the same image data can be obtained. Therefore, it can ask for the depth position of the predetermined photographic subject in a picture easily by performing the same processing as a conventional example from the obtained image data.
[0024]It may be made to change the logging range of two or more image data seen from two or more viewpoints depended on the picture slicing part 17 by a value obtained by a nonlinear predetermined function which makes a viewpoint interval a variable. If it does in this way, an optic axis of a camera lens can be rotated for the whole camera focusing on a predetermined point, and image data from two or more viewpoints further acquired by moving the whole camera in parallel with an optic axis of a camera lens and same image data can be obtained.
[0025]In this embodiment, the picture slicing part 17 about image data in case the image formation part 14 for azimuth difference is in the 1st view position. The range of predetermined width centering on a position of an acceptance surface of the image pick-up part 16 for azimuth difference equivalent to an optic axis (optic axis 1) of the image formation part 14 for azimuth difference concerned is started, About image data in case the image formation part 14 for azimuth difference is in the 2nd view position. A range which shifted a logging range in case the said range 14 of predetermined width

centering on a position of an acceptance surface of the image pick-up part 16 for azimuth difference equivalent to an optic axis (optic axis 2) of the image pick-up part 1 for azimuth difference concerned, i.e., said image formation part for azimuth difference, is in the 1st view position by an interval of the 1st and 2nd view positions is started. This is an example at the time of changing the above-mentioned logging range by a value obtained by a linearity function.

[0026]The picture slicing part 17 as a method of starting image data of a predetermined range from image data, It may be made to start image data of a predetermined range from image data of an analog signal changed into the image pick-up part 16 for azimuth difference, After the image pick-up part 16 for azimuth difference changes image data of an analog signal into image data of a digital signal, it may be made to start image data which shows a predetermined range from the image data concerned.

[0027]The parallax picture storage parts store 18 memorizes the image data of the external world seen from two or more viewpoints started by the picture slicing part 17. The depth primary detecting element 20 shifts based on the image data seen from a different viewpoint memorized by the parallax picture storage parts store 18 by performing corresponding-points decision processing about the predetermined photographic subject of the external world, and calculates quantity. Since corresponding-points decision processing is technology known conventionally, it omits explanation. Corresponding-points decision processing is indicated to the "Chapter 8 stereo **" etc. of "computer vision:technical comment, a future view, New technology Communications, 1998, ISBN4-915851-17-6."

[0028]The depth primary detecting element 20 performs depth position detection processing which detects the depth position (depth information) of a photographic subject based on the amount of gaps concerned. The function which shows the relation between the amount of gaps and a depth position is searched for beforehand, and it may be made to compute a depth position by shifting to the function concerned and substituting quantity in depth position detection processing. The correspondence relation between the amount of gaps and a depth position is held as a table, and it shifts from the table concerned and may be made to take out the depth position corresponding to quantity. Since the relation between the amount of gaps and a depth position can be expressed based on the principle of triangulation known conventionally, the character of a lens, the principle of geometry, etc., for example, it omits explanation here.

[0029]The depth storage parts store 22 memorizes the depth position of the photographic subject detected by the depth primary detecting element 20. The control section 30 controls the focus of the image formation part 24, the imaging operation by the image pick-up part 26, etc. based on the depth position of the predetermined photographic subject memorized by the depth storage parts store 22. Here the storage parts store 28, the parallax picture storage parts store 18, and the depth storage parts store 22, RAM established permanently in the imaging device 10, respectively (Random Access Memory), To the imaging device 10, it may be a flash memory and they may be [it is removable, for example] recording media, such as a floppy disk, MD (Mini Disk), and SmartMedia (trademark).

[0030]Drawing 2 is a figure explaining the photographing operation of the picture by the imaging device concerning a 1st embodiment of this invention. Drawing 2 (A) is a figure explaining photography in case the image formation part 14 for azimuth difference is in the 1st view position, and drawing 2 (B) is a figure explaining photography in case the image formation part 14 for azimuth difference is in the 2nd view position. Here, the X-axis shall be taken in parallel with the move direction of the image formation part 14 for azimuth difference. The photographic subject A whose distance parallel to an optic axis from the image formation part 14 for azimuth difference in the external world is the distance A. There is the photographic subject C whose distance parallel to an optic axis is infinity (infinity) from the photographic subject B whose distance parallel to an optic axis from the image formation part 14 for azimuth difference is the distance B, and the image formation part 14 for azimuth difference, and it is assumed that the photographic subject A, B, and C is located in a line sequentially from the one where the value of the X-axis in a figure is larger.

[0031]The actuator 15 makes the 1st view position maintain the image formation part 14 for azimuth difference first in the imaging device 10. The optic axis of the image formation part 14 for azimuth difference in the 1st view position is used as the optic axis 1. Thereby, in the 1st view position, the picture of the external world is connected via the image formation part 14 for azimuth difference on the acceptance surface of the image pick-up part 16 for azimuth difference. As shown in drawing 2

(A), the image of each photographic subject is connected to the image pick-up part 16 for azimuth difference in order of the photographic subject C, B, and A sequentially from the one where the value of the X-axis is larger, for example. The image pick-up part 16 for azimuth difference changes into image data the picture connected on the acceptance surface.
[0032]Subsequently, it is made to move to the 2nd view position, the actuator 15 maintaining the optic axis of the image formation part 14 for azimuth difference in parallel with the optic axis 1. Here, the optic axis of the image formation part 14 for azimuth difference in the 2nd view position is used as the optic axis 2. Thereby, in the 2nd view position, the picture of the external world is connected via the image formation part 14 for azimuth difference on the acceptance surface of the image pick-up part 16 for azimuth difference. As shown in drawing 2 (B), the image of each photographic subject is connected to the image pick-up part 16 for azimuth difference in order of the photographic subject C, B, and A sequentially from the one where the value of the X-axis is larger. As compared with the position of the image shown in drawing 2 (A), all the photographic subjects A, B, and C are connected to the position shifted in the direction which becomes small, the value of the X-axis shifts in order of the photographic subject C, B, and A, and the position of the image shown in drawing 2 (B) has much quantity. The image pick-up part 16 for azimuth difference changes into image data the picture connected on the acceptance surface.
[0033]Drawing 3 is a figure explaining logging operation of the picture concerning a 1st embodiment of this invention. Drawing 3 is a figure explaining logging operation of a picture as shown in drawing 2, when a picture is connected in the 1st view position and the 2nd view position. The picture slicing part 17 starts the 1st image data shown in drawing 3 (C) contained in predetermined width focusing on the position of the acceptance surface of the image formation part 16 for azimuth difference equivalent to the optic axis 1 to the image connected to the image formation part 16 for azimuth difference in the 1st view position as shown in drawing 3 (A). The picture slicing part 17 starts the 2nd image data shown in drawing 3 (D) contained in predetermined width focusing on the position of the acceptance surface of the image formation part 16 for azimuth difference equivalent to the optic axis 2 to the image connected to the image formation part 16 for azimuth difference in the 2nd view position as shown in drawing 3 (B).
[0034]If the 1st image data started in this way and the 2nd image data are piled up, the amount of gaps of the same photographic subject between both-images data will appear greatly, so that the same photographic subject C with an infinite distance is in agreement and the distance of a photographic subject becomes near, as shown in drawing 3 (E). As opposed to the image data which the image data shown in drawing 3 (E) is the image data from two or more viewpoints acquired by making move the whole camera shown in a conventional example in parallel with the optic axis of a camera lens, and same image data, and was obtained, It can ask for the depth position of the predetermined photographic subject in a picture easily by performing the same processing as a conventional example. These image data is memorized by the parallax picture storage parts store 18.
[0035]Next, the processing after making the image data in the imaging device 10 memorize is explained. Based on the image data which was started by the picture slicing part 17 and memorized by the parallax picture storage parts store 18 as mentioned above in the imaging device 10, The depth position of the photographic subject concerned which the depth primary detecting element 20 shifted about the predetermined photographic subject of the external world by corresponding-points decision processing, detected quantity, and detected the depth position about the photographic subject concerned based on the amount of gaps concerned and in which the depth storage parts store 22 was detected is memorized.
[0036]Subsequently, the control section 30 controls the image formation part 24 and the image pick-up part 26 based on the depth position of the photographic subject memorized by the depth storage parts store 22. Thereby, the image formation part 24 collects the lights from the external world, and connects the picture of the photographic subject of the external world on the acceptance surface of the image pick-up part 26. And the image pick-up part 26 changes into image data the picture connected on the self acceptance surface, and the storage parts store 28 memorizes the image data changed by the image pick-up part 26.
[0037]At this time, the storage parts store 28 is faced incorporating the image data which self memorizes, and the image data concerned, The matching information which matches the depth position of the photographic subject which is computed by the picture from two or more viewpoints

which were incorporated by the image pick-up part 16 for azimuth difference, and were memorized by the parallax picture storage parts store 18, and the picture from two or more viewpoints concerned, and is memorized by the depth storage parts store 22 is also memorized. Thereby, image data, the picture from two or more viewpoints related with the image data concerned, and the depth information of the photographic subject included in the image data concerned can be matched and used behind.
[0038]As mentioned above, only by moving only the image formation part 14 for azimuth difference, without moving the imaging device 10 whole, Since the image of the external world seen from two or more viewpoints can be captured, it is not necessary to have a drive system which moves the imaging device 10 whole, and things can be carried out and the cost concerning an imaging device and a parallax image input device which miniaturizes the size of an imaging device and a parallax image input device can be reduced. It can ask for the depth position of the predetermined photographic subject in a picture easily.
[0039]Drawing 4 is a figure showing the composition of the imaging device containing the parallax image input device concerning a 2nd embodiment of this invention. Here, identical codes are given to the element which has the same function as the element of the imaging device of a 1st embodiment shown in drawing 1. In the imaging device 10 of a 1st embodiment, this imaging device 10 is changed into the actuator 15, is provided with the actuator 32 as an example of the image pick-up part actuator for azimuth difference, and has composition which removed the picture slicing part 17. Here, the image formation system said to Claims is constituted by the image formation part 24 and the image formation part 14 for azimuth difference, and an imaging system is constituted from this embodiment by the image pick-up part 26 and the image pick-up part 16 for azimuth difference.
[0040]the actuator 32 -- the function of the actuator 15 of a 1st embodiment -- in addition, it has further the function to make the image pick-up part 16 for azimuth difference drive. The actuator 32 changes the position of the image pick-up part 16 for azimuth difference which captures the image seen from each viewpoint based on the interval of the parallax directions to which the viewpoint of two or more viewpoints is connected. It may be made to change the actuator 32 here by the value obtained [interval / of the parallax directions of these viewpoints] by the linearity predetermined function made into a variable in the position of each image pick-up part 16 for azimuth difference at the time of incorporating each image data seen from two or more viewpoints. If it does in this way, the image data from two or more viewpoints acquired by making move the whole camera as shown in a conventional example in parallel with the optic axis of a camera lens, and the same image data can be obtained. Therefore, it can ask for the depth position of the predetermined photographic subject in a picture easily by performing the same processing as a conventional example from the obtained image data.
[0041]It may be made to change the actuator 32 by the value obtained [intervals / these / viewpoint] by the nonlinear predetermined function made into a variable in the position of each image pick-up part 16 for azimuth difference at the time of incorporating each image data seen from two or more viewpoints. If it does in this way, the optic axis of a camera lens can be rotated for the whole camera focusing on a predetermined point, and the image data from two or more viewpoints further acquired by moving the whole camera in parallel with the optic axis of a camera lens and the same image data can be obtained.
[0042]In this embodiment, when the image formation part 14 for azimuth difference is in the 1st view position, the actuator 32, So that the center of the X axial direction of the acceptance surface of the image pick-up part 16 for azimuth difference and the optic axis (optic axis 1) of the image formation part 14 for azimuth difference concerned may be in agreement, When the image pick-up part 16 for azimuth difference is moved and the image formation part 14 for azimuth difference is in the 2nd view position, the image pick-up part 16 for azimuth difference is moved so that the center of the X axial direction of the acceptance surface of the image pick-up part 16 for azimuth difference and the optic axis (optic axis 2) of the image formation part 14 for azimuth difference concerned may be in agreement. This is an example at the time of changing the above-mentioned logging range by the value obtained by a linearity function.
[0043]Drawing 5 is a figure explaining the photographing operation of the parallax picture by the imaging device concerning a 2nd embodiment of this invention. Drawing 5 (A) is a figure explaining photography in case the image formation part 14 for azimuth difference is in the 1st view position, and drawing 5 (B) is a figure explaining photography in case the image formation part 14 for azimuth

difference is in the 2nd view position. The photographic subject A whose distance parallel to an optic axis from the image formation part 14 for azimuth difference in the external world is the distance A here. There is the photographic subject C whose distance parallel to an optic axis is infinity (infinity) from the photographic subject B whose distance parallel to an optic axis from the image formation part 14 for azimuth difference is the distance B, and the image formation part 14 for azimuth difference, and it is assumed that the photographic subject A, B, and C is located in a line sequentially from the one where the value of the X-axis in a figure is larger.

[0044]In the imaging device 10, first, while the actuator 32 makes the 1st view position maintain the image formation part 14 for azimuth difference, the image pick-up part 16 for azimuth difference is maintained so that the center of an optic axis (optic axis 1) of the image formation part 14 for azimuth difference concerned and the X-axis of an acceptance surface in the 1st view position may be in agreement. Thereby, in the 1st view position, a picture of the external world is connected via the image formation part 14 for azimuth difference on an acceptance surface of the image pick-up part 16 for azimuth difference. As shown in drawing 5 (A), an image of each photographic subject is connected to the image pick-up part 16 for azimuth difference in order of the photographic subject C, B, and A sequentially from the one where a value of the X-axis is larger, for example. The image pick-up part 16 for azimuth difference changes into image data a picture connected on an acceptance surface.

[0045]Subsequently, while making it move to the 2nd view position, the actuator 32 maintaining an optic axis of the image formation part 14 for azimuth difference in parallel with the optic axis 1, the image pick-up part 16 for azimuth difference is moved so that the center of an optic axis (optic axis 2) of the image formation part 14 for azimuth difference concerned and the X-axis of an acceptance surface in the 2nd view position may be in agreement. Thereby, in the 2nd view position, a picture of the external world is connected via the image formation part 14 for azimuth difference on an acceptance surface of the image pick-up part 16 for azimuth difference. As shown in drawing 5 (B), an image of each photographic subject is connected to the image pick-up part 16 for azimuth difference in order of the photographic subject C, B, and A sequentially from the one where a value of the X-axis is larger. The image pick-up part 16 for azimuth difference changes into image data a picture connected on an acceptance surface.

[0046]Thus, if the 1st image data changed into the image pick-up part 16 for azimuth difference and the 2nd image data are piled up, as shown in drawing 5 (C), the same photographic subject C with an infinite distance is in agreement, and the amount of gaps of the same photographic subject between both-images data will appear greatly, so that the distance of a photographic subject is near. As opposed to the image data which the image data shown in drawing 5 (C) is the image data from two or more viewpoints acquired by making move the whole camera shown in a conventional example in parallel with the optic axis of a camera lens, and same image data, and was obtained, It can ask for the depth position of the predetermined photographic subject in a picture easily by performing the same processing as a conventional example. This 1st image data and 2nd image data are memorized by the parallax picture storage parts store 18. About the processing after making the image data in the imaging device 10 memorize, since it is the same as that of a 1st above-mentioned embodiment, explanation is omitted here.

[0047]Thus, only by moving the image formation part 14 for azimuth difference, and the image pick-up part 16 for azimuth difference, without moving the imaging device 10 whole, Since the image from two or more viewpoints can be captured, it is not necessary to have equipment of the drive system which moves the imaging device 10 whole, and things can be carried out and the cost concerning an imaging device and a parallax image input device which miniaturizes the size of an imaging device and a parallax image input device can be reduced. It is not necessary to give a margin to the acceptance surface of the image pick-up part 16 for azimuth difference, the image pick-up part 16 for azimuth difference can be miniaturized, and cost can be reduced. It can ask for the depth position of the predetermined photographic subject in a picture easily.

[0048]Next, the imaging device concerning a 3rd embodiment of this invention is explained. Drawing 6 is a figure showing the composition of the parallax image input device of the imaging device concerning a 3rd embodiment of this invention. The imaging device concerning a 3rd embodiment changes the composition of the parallax image input device body part 12 of the imaging device concerning a 1st embodiment shown in drawing 1. Here, about the same functional element as the composition in the parallax image input device body part 12 shown in drawing 1, the same mark is

attached and the overlapping explanation is omitted. This parallax image input device body part 12 is provided with the following.
The image formation part 14 for azimuth difference.
Shutter part 50.
The image pick-up part 16 for azimuth difference.
The picture slicing part 17, the parallax picture storage parts store 18, the depth primary detecting element 20, the depth storage parts store 22, and the control section 52.
Here, the image formation system said to Claims is constituted by the image formation part 24 and the image formation part 14 for azimuth difference, and an imaging system is constituted from this embodiment by the image pick-up part 26 and the image pick-up part 16 for azimuth difference. The shutter part 50 has the opens parts 50A and 50B used as a viewpoint which can be opened and closed. As for the shutter part 50, it is preferred to be arranged in the pupil surface of the image formation part 14 for azimuth difference or its neighborhood. The control section 52 controls each part. For example, he is controlling opening and closing of the opens parts 50A and 50B of the shutter part 52, and is trying to open a gap or one side.
[0049]Drawing 7 is a figure explaining the photographing operation of the picture seen from two or more viewpoints depended on the imaging device concerning a 3rd embodiment of this invention. Drawing 7 (A) is a figure explaining photography of the picture seen from the opens part 50A, and drawing 7 (B) is a figure explaining photography of the picture seen from the opens part 50B. The photographic subject A whose distance parallel to an optic axis from the image formation part 14 for azimuth difference in the external world is the distance A here. There is the photographic subject C whose distance parallel to an optic axis is the distance C from the photographic subject B whose distance parallel to an optic axis from the image formation part 14 for azimuth difference is the distance B, and the image formation part 14 for azimuth difference, and it is assumed that the photographic subject A, B, and C is located in a line sequentially from the one where the value of the X-axis in a figure is larger. A distance parallel to an optic axis from the image formation part 14 for azimuth difference of the field of the distance B is the focal point surface of the image formation part 14 for azimuth difference.
[0050]In the parallax image input device body part 12, first, the control section 52 opens the opens part 50A of the shutter part 50, and closes the opens part 50B. Thereby, the picture of the external world is connected via the opens part 50A on the acceptance surface of the image pick-up part 16 for azimuth difference. As shown in drawing 7 (A), the image of each photographic subject is connected to the image pick-up part 16 for azimuth difference in order of the photographic subject C, B, and A sequentially from the one where the value of the X-axis is larger, for example. The image pick-up part 16 for azimuth difference changes into image data the picture connected on the acceptance surface.
[0051]Subsequently, the control section 52 opens the opens part 50B of the shutter part 50, and closes the opens part 50A. Thereby, the picture of the external world is connected via the opens part 50B on the acceptance surface of the image pick-up part 16 for azimuth difference. As shown in drawing 7 (B), the image of each photographic subject is connected to the image pick-up part 16 for azimuth difference in order of the photographic subject C, B, and A sequentially from the one where the value of the X-axis is larger, for example. As compared with the position of the image shown in drawing 7 (A), the position of the image shown in drawing 7 (B). The position of the image of the photographic subject B located on the focal point surface does not change, but the image of the photographic subject A located in the image formation part 14 side for azimuth difference from the focal point surface is connected to the position shifted in the direction to which the value of the X-axis becomes small, and the image of the photographic subject C located in the distance from the focal point surface is connected to the position shifted in the direction to which the value of the X-axis becomes large. The image pick-up part 16 for azimuth difference changes into image data the picture connected on the acceptance surface.
[0052]Drawing 8 is a figure explaining logging operation of a picture concerning a 3rd embodiment of this invention. Drawing 8 is a figure explaining logging of a picture connected via the opens part 50A or the opens part 50B as shown in drawing 7. The picture slicing part 17 starts the 1st image data shown in drawing 8 (C) contained in a predetermined range to an image connected via the opens part 50A as shown in drawing 8 (A). Predetermined makes distance movement of said range carry out in

the direction to which a value of the X-axis becomes small to an image connected via the opens part 50B, as shown in drawing 8 (B), and the picture slicing part 17 starts the 2nd image data shown in drawing 8 (D).

[0053]If the 1st image data started in this way and the 2nd image data are piled up, the amount of gaps of the same photographic subject between both-images data will appear greatly, so that the distance of a photographic subject is far, as shown in drawing 8 (E). Thus, since it shifts, so that a photographic subject is far, and quantity appears greatly, depth can be specified only by calculating the relative amount of gaps of a photographic subject based on the image data seen from two or more viewpoints, and a throughput can be reduced. Supposing it calculates the amount of gaps of each photographic subject using drawing 8 (A) and (B) as compared with this, it will not be able to be specified in any before and behind the focal point surface a photographic subject is, but it will be necessary to also recognize the direction which a gap generates, and, for this reason, processing will become complicated only in the relative amount of gaps. The 1st image data and the 2nd image data which were started by doing in this way are memorized by the parallax picture storage parts store 18. About the processing after making the image data in the imaging device 10 memorize, since it is the same as that of a 1st above-mentioned embodiment, explanation is omitted here.

[0054]This invention is not limited to the above-mentioned embodiment, and various modification is possible for it. For example, although the example was shown using CCD as the image pick-up part 26, this invention is not restricted to this, but is provided with the installation section which installs the film as an example of a photochemical reaction component in the image pick-up part 26, for example, and it may be made to picturize a picture in the above-mentioned embodiment by the film installed in the installation section. In the above-mentioned embodiment, although explained taking the case of the digital camera, this invention is not restricted to this but can also be applied to other imaging devices, such as an endoscope which observes the inside of human being's abdominal cavity.

[0055]Although the range which captures an image by moving the image pick-up part 16 for azimuth difference which changes the range of image data to start, or captures an image was changed in the above-mentioned embodiment, This invention is not restricted to this, but the range of the picture to start is changed and it may be made to change the range which captures an image by moving the image pick-up part for azimuth difference which captures an image.

[0056]In the above-mentioned embodiment, although it had the image formation part 14 for azimuth difference and the image formation part 24 of another composition, this invention is not restricted to this but may have only a lens system with a single image formation system. In this case, a single lens system may constitute the image formation part 14 for azimuth difference, and the image formation part 24, and it may be made to make the picture of the external world connect to the image pick-up part 16 for azimuth difference, and the image pick-up part 26 by the light branching means of prism etc. A part of image formation part 14 for azimuth difference and image formation part 24 may be made common composition. Although the imaging system had two or more image pick-up parts 16, i.e., image pick-up part for azimuth difference, and image pick-up parts 26, this invention is not restricted to this but may have only an image pick-up part with a single imaging system. In this case, a single image pick-up part may function as the image pick-up part 16 for azimuth difference, and the image pick-up part 26.

[0057]Although CCD was used as the image pick-up part 16 for azimuth difference, this invention is not restricted to this, but is provided with the installation section which installs a film in the image pick-up part 16 for azimuth difference also as an example of a photochemical reaction component, for example, and it may be made to picturize a picture in the above-mentioned embodiment by the film installed in the installation section. If it does in this way, the picture from two or more viewpoints which developed the film and were incorporated into the film, For example, if the image data to incorporate is started according to the interval during the viewpoint at the time of capturing these images when incorporating as digital image data by a film scanner etc., processing at the time of detecting the depth position to a predetermined photographic subject [image data / concerned] can be made easy.

[0058]As mentioned above, although this invention was explained using the embodiment, technical scope of this invention is not limited to the range given in the above-mentioned embodiment. It is clear to a person skilled in the art that various change or improvement can be added to the above-mentioned embodiment. It is clear from the description of Claims that the form's which added such

change or improvement it may be contained in technical scope of this invention.
[0059]
[Effect of the Invention]According to this invention, a parallax picture can be easily incorporated so that clearly from the above-mentioned explanation. The depth information of the photographic subject of the external world can be acquired easily.

[Translation done.]

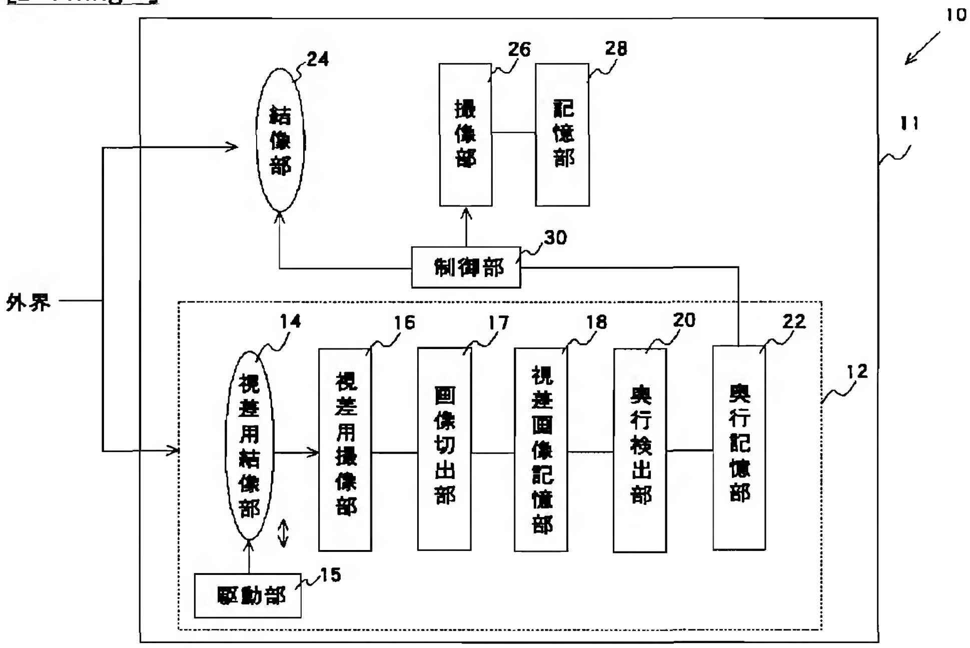
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a figure showing the composition of the imaging device containing the parallax image input device concerning a 1st embodiment of this invention.
[Drawing 2]It is a figure explaining the photographing operation of the picture by the imaging device concerning a 1st embodiment of this invention.
[Drawing 3]It is a figure explaining logging operation of the picture concerning a 1st embodiment of this invention.
[Drawing 4]It is a figure showing the composition of the imaging device containing the parallax image input device concerning a 2nd embodiment of this invention.
[Drawing 5]It is a figure explaining the photographing operation of the picture by the imaging device concerning a 2nd embodiment of this invention.
[Drawing 6]It is a figure showing the composition of the parallax image input device of the imaging device concerning a 3rd embodiment of this invention.
[Drawing 7]It is a figure explaining the photographing operation of the picture by the imaging device concerning a 3rd embodiment of this invention.
[Drawing 8]It is a figure explaining logging operation of the picture concerning a 3rd embodiment of this invention.
[Explanations of letters or numerals]
10 Imaging device 12 parallax image input device
11 Case Image formation part for 14 azimuth difference
15 32 Actuator Image pick-up part for 16 azimuth difference
17 Picture slicing part 18 parallax-picture storage parts store
20 Depth primary detecting element 22 depth storage parts store
24 Image formation part 26 image-pick-up part
28 Storage parts store 30 52 Control section
50 Shutter part

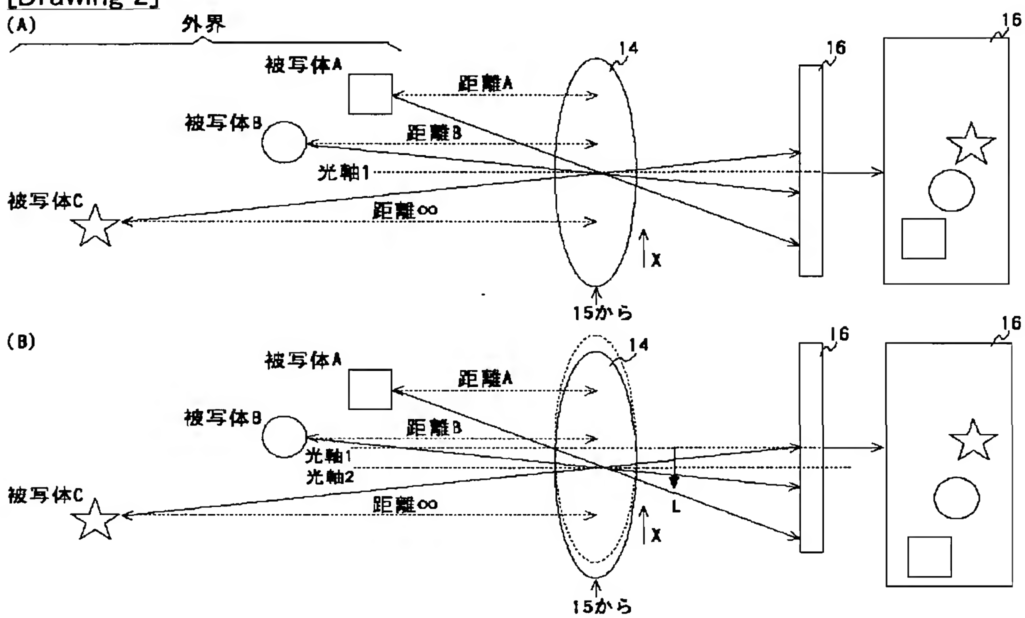
[Translation done.]

DRAWINGS

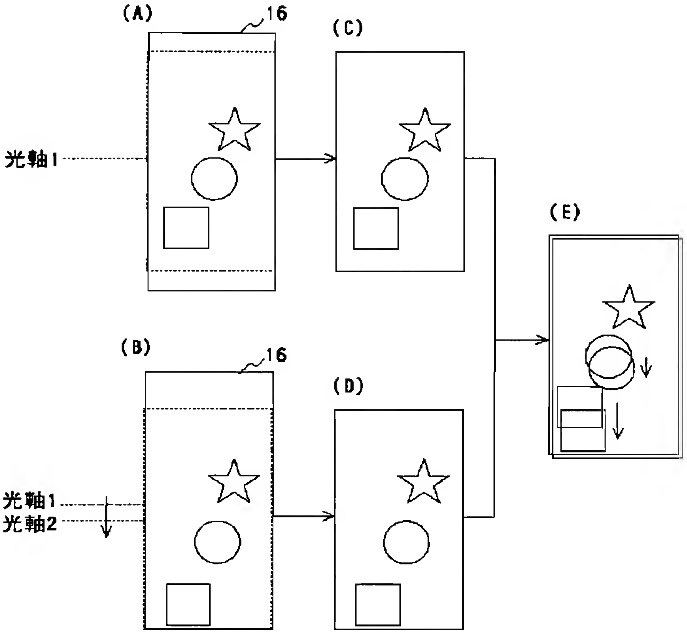
[Drawing 1]



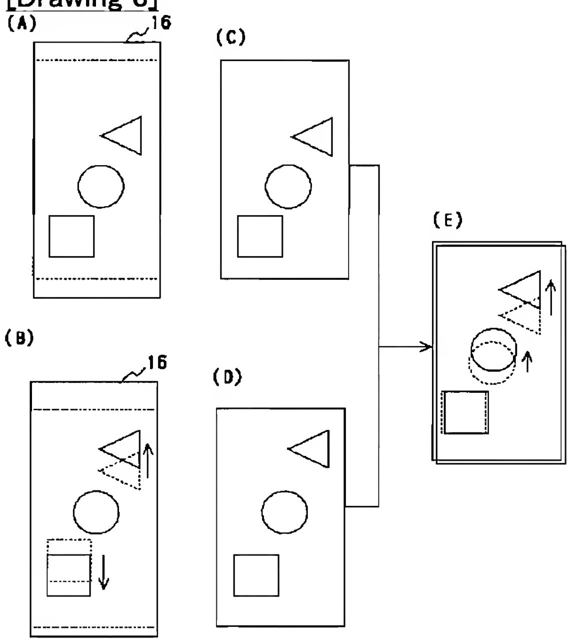
[Drawing 2]



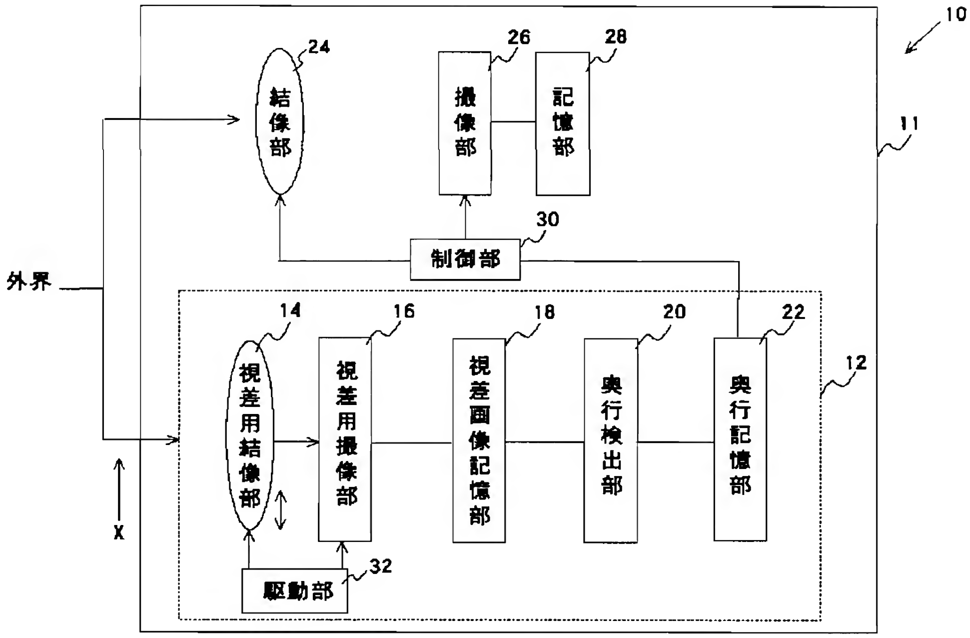
[Drawing 3]



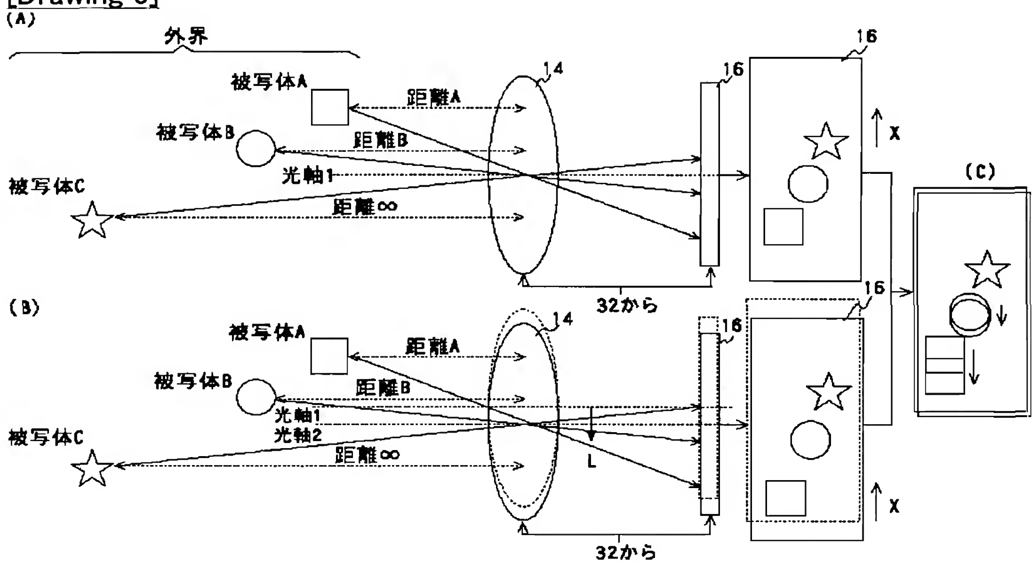
[Drawing 8]



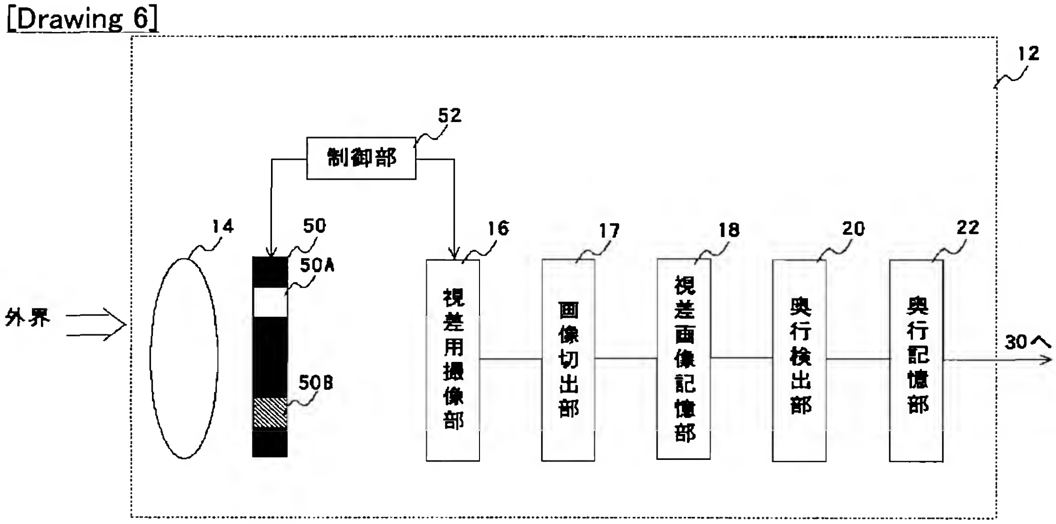
[Drawing 4]



[Drawing 5]

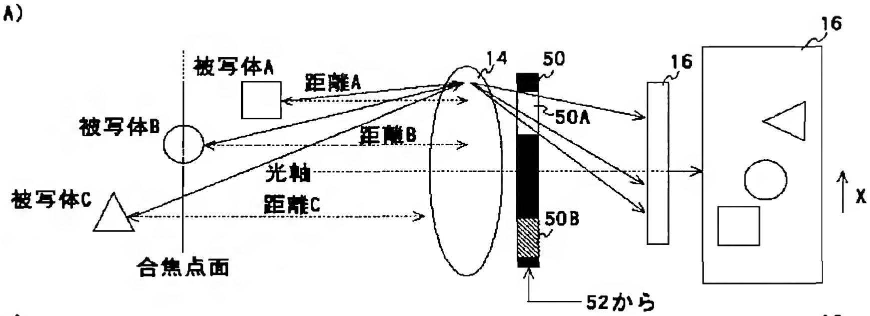


[Drawing 6]

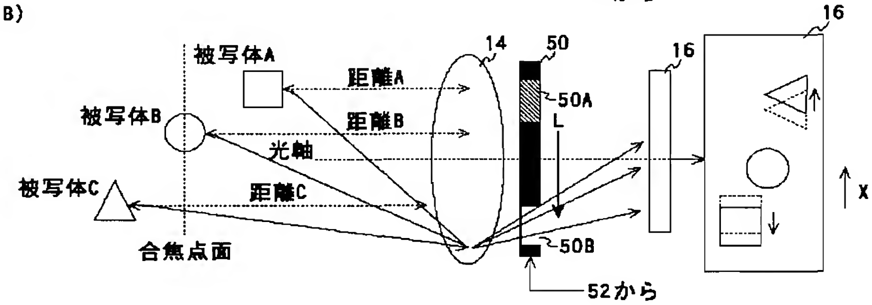


[Drawing 7]

(A)



(B)



[Translation done.]